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(Cambodge, Laos, Thailand and Viet-Nam)

NAM NGUM TRIBUTARY PROJECT IN LAOS

Note on Current Energy Consumption in the Vientiane Area and Anticipated Consumption Increase

by

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Market Survey

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S O F R E L E C

Bangkok 1st August 1963

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Executive Agent
Committee for Co-ordination of
Investigations of the Lower
Mekong Basin
ECAFE

BANGKOK

Bernard LEFORT
National Energy Authority

BANGKOK

SUBJECT : Electric Power Market
Kingdom of Laos

REF : BL/SP - No.58
AD : Note on the current energy situation in Vientiane.

Dear Sir,

In connexion with your letter MP/18 770 - 6/1 of 9 July 1963, I beg to submit a note reflecting the data gathered during my short stay in Vientiane.

The statement on the prospects of increase in the energy consumption does not follow the same pattern as the verbal statement made in your office on 9 June 1963. I believe that the new pattern is much less open to discussion.

May I once more point out that the assumptions are conservative and may be increased as the survey is progressing.

According to the provisions of the plan of operation, the text of the note is in the French language. I should be thankful if you would send me, before it is published, 3 or 4 copies of the translation as prepared by your services.

Thanking you in anticipation,

Sincerely yours,

B. LEFORT

Lower Mekong Basin

Electric Power Market Surveys

Kingdom of LAOS

1.- INTRODUCTION

The following note was drafted after a short stay in Vientiane and a brief and necessarily summary analysis of the current data of the energy market. It was prepared at the request of the Executive Agent of the Committee for Co-ordination of Investigations of the Lower Mekong Basin. It aims at describing the current power situation in the Vientiane area and evaluating the possible consumption increases.

The data it contains are conservative in character. They are given within the overall frame of the electric power market survey for which other activities are still in progress. This means that the figures given might be later revised upward as this survey is developing.

2.- CONCLUSIONS

As shown below (see among others pages 10-11), the future power production for the supply of Vientiane can only be from hydraulic origin.

Thermal plants never will, in fact, owing to the impact of the high fuel and lubricating oils costs on the power cost price, ensure a normal development of energy for household and industrial uses.

The data on which our estimates are based do not take into account possible energetic complements (pumping, exports etc...)

Our assumptions in connexion with consumption increases are very conservative. It is reasonable to think that it will develop rapidly with

/ the gradual

the gradual reduction of rates and the rising the standard of living attending upon the expansion of the gross national income.

It may be pointed out that from a financial viewpoint, the Vientiane power supply Company's situation is very sound, which will permit the development cycle to be started with a significant lowering of the rates without jeopardizing the financial balance. All that is needed to that effect is that the available power be firm.

The harnessing of the Nam Ngum, as contemplated that in this first stage, would undoubtedly pay. The sale of power to Vientiane and its area would in itself suffice for the payment of interests as well as for the instalments on a low interest loan granted for a long period.

This harnessing is also essential for the development of the area and it would be unfortunate if construction was deferred. This situation would create a bottleneck in the growth of Vientiane, which would be highly detrimental to the economy of the region.

/ 3.- CURRENT

3.- CURRENT SITUATION OF THE ENERGY MARKET

3.1 - General

The power supply in Vientiane area is characterized by:

1) its localized character. The city has its own production plants without any interconnexion with other centers. These are all very distant and their capacity is obviously inadequate for possible energy exchanges.

2) the marked inadequacy of the production, coupled with high rates, with following consequences:

- a supply limited to a restricted number of consumers;
- power failures whenever one of the generating group breaks down, alternating with voltage drops.

The above factors led a number of organizations (USOM, Army, Airport, Banks, Legations etc ...) to have their own independent production plants.

The total power thus installed amounts, according to the estimates of the Service du Plan, to some 3,800 kW. This amount can be usefully compared with the amount of the concessionary society (2,832 kW). Such consumers could be linked up to the distribution networks if production plants were adequate.

3.2 - General informations available

3.21 Population

No census, in the international meaning of the term, was ever taken. The numbers given are estimates. The margin for error is wide, and there may be 15% gap between the actual and the estimated numbers. In the case of Vientiane, it seems that the margin might be narrower, and that it could be set at about 7%.

An often-quoted estimate for the city of Vientiane puts at 75,000 the number of its inhabitants in 1960. Such was the figure adopted for the preparation of the town-planning projects. It was taken as a basis for assumptions in connexion with the evaluation of future needs.

/ 3.22 - Number

3.22 - Number of consumers

The number of consumers served by the Electricité du Laos was 3,857 on 31st December 1962. The increase between 1961 and the end of 1962 was 15% despite the numerous deterrents devised by Electricité du Laos.

It may be pointed out that the increase between 1960-1961 was 9%.

3.23 - Installed power and available power

The power installed by the concessionary firm in kVA, and available in kW, are respectively:

kVA	=	4 290
kW	=	2 832

The motors are of the diesel, fuel-oil consuming type.

None of the generators can be used in parallel with another, which in actual practice reduces the available power.

The daily variations in the power demand result in numerous stops and re-startings, which cannot but result in a significant increase of fuel consumption.

Fuel consumption is high.

3.24 - Peak power

The peak load reached 2 130 kW in 1962. It had been 1 841 kW in 1961. The margin between the available power and the peak load is narrow. At the least breakdown of worn out generators, interruptions occur in some section of the distribution network.

3.25 - Load curves

The characteristic load curves of the production in Vientiane for 1961 are shown in annex. They indicate the fluctuations for winter (November) and for summer (June).

/ These curves

These curves are established by adding up and plotting every half hour on the chart the instaneous output of each generator in service.

The number of daily kWH generated is determined by the integration of the curve thus obtained.

The curve pattern has been schematized for the period between 7 a.m. and 6 p.m., differences of plus or minus 10% occurring every day, but without any regularity.

An examination of those curves shows the following:

- a summer peak, 15% lower than the winter peak;
- a daytime power demand lower than the nightime demand (12.30 p.m. to 7 a.m.).

This daytime demand is all the year round equal to one third of the winter peak power demand.

- a sharp rise, followed by a slow decline;
- a time-lag of 1 hour at most between winter-time peak and summer-time peak;
- a striking superposition of the downward curve of the winter and summer peaks;
- lastly, in winter time, a slight rise of lighting demand between 5 and 7 a.m., with a small peak at 6 p.m., which vanishes in summer.

In short, except for the peak period, nothing but low-demand hours.

All of which shows clearly the lack of any industrial uses and will be used in the preparation of development projects.

3.26 - Production

A comparative study of productions between 1960 - 1961 - 1962 shows the following increases:

1960 - 1961	:	18.7 %
1961 - 1962	:	18.5 %

/ 3.27

3.27 - Consumption

Energy consumption for 1960 - 1961 - 1962 is as follows:

1960	3 988 000 kWh
1961	4 561 000 kWh
1962	5 542 000 kWh

A comparison between consumption and production shows that the theoretical output of the network is as follows:

1960	0.785
1961	0.756
1962	0.775

The explanation of those differences is to be found in the evaluation of flat-rates.

3.28 - Utilization

The low tension utilization duration has been, respectively:

- 2 480 hours in 1961
- 2 580 hours in 1962

of the peak power.

3.29 - Networks

In 1961, the distribution networks were as follows:

Medium tension	6 600 volts		
Low tension	127 / 220 volts		
Length of one-conductor lines		M.T.	: 44 520 km
Length of one-conductor lines		L.T.	: 238 705 km
Weight of copper		M.T.	: 10 325 kg
Weight of copper		L.T.	: 50 622 kg
Transformers		number	: 29
		Power	: 2 355 kVA

/ 4.- ANTICIPATED

4.- ANTICIPATED EXPANSION OF CONSUMPTION

4.1 - General

It seems that, from now until 1970, distribution development possibilities will have to be considered in the light of two factors:

- distribution will remain restricted to the Vientiane area without interconnexion.
- a hydraulic power is the solution to the problem.

This viewpoint can be justified as follows:

DISTRIBUTION WITHOUT INTERCONNEXION:

Laos is over 1,000 km long from North to South.

Distance (as the crow flies) between the main cities is:

From North to South : 215 km from LUANG-PRABANG to VIENTIANE
220 km " VIENTIANE to THAKHEK
100 km " THAKHEK to SAVANNAKHET
200 km " SAVANNAKHET to PAKSE
95 km " PAKSE to SARAVANE.

Population density is very low (about 10 inhabitants/km^2), and outside the cities proper, this population is extremely scattered.

Owing to the low consumption involved and the distance over which energy would have to be transmitted, interconnexion would not pay.

- PRIORITY OF A HYDRAULIC SOLUTION

The economic development of Laos, both from the industrial and the agricultural viewpoints, is imperatively linked to the development of utilisation, and consequently of the energy production.

The utilization of energy can only be developed if the present production cost is considerably lowered, which would allow EdL to offer its consumers normal differential rates, allowing in particular factories, craftsmen and co-operatives of transformation and conditioning to attain competitive prices for exportation.

/ Present

Present power production, being based on fuel-oil leads because the expensive price of this product, to costs which preclude the desired diffusion. The improved output of the new generators envisaged for Vientiane will only bring inadequate improvement of the kWh cost.

On the other hand, the general economy of Laos shows an adverse trade balance and this so far could only be compensated by external help. But this situation is fraught with perils and an absolute and vital necessity for the Kingdom to free itself from all non-vitally needed imports.

The country must therefore resolutely look towards a production entirely liberated from the necessity of resorting to importation.

Such production can only be of the hydraulic kind, by priority, whenever this is possible.

Hydraulic production has the great advantage of permitting, without an important increase of the operation costs, an ever-improving utilization of the installed power, which makes it possible to offer the consumers, outside the peak lighting period, very attractive rates.

An essential factor of hydro-electric energy cost at the power-plant being the payments on invested capital, one must as far as possible adjust the capacity of the equipment to the anticipated demand. This demand can be assessed in five-year periods, and the initial plant will have to be installed in such a way that the installation of further units will raise no problems.

This will make it possible to ensure a reduced cost of energy over the whole development period,as well as a minimum interim interest, the successive investments being made shortly before their utilization.

4.2 - NEW THERMAL INSTALLATION OF VIENTIANE

The peak load of the EdL power plant was:

1 600 kW in 1960
1 841 kW in 1961
2 143 kW in 1962

/ The yearly

The yearly increase is from 250 to 300 kW despite the deterring policy of the distributing firm. If we compare the above figures with the total available power (2 830 kW) it will be seen that the present margin between this available power and the peak load is decreasing very rapidly.

Faced with this situation, the Laotian authorities decided to build a new Diesel plant. Its capacity will be 4 000 kW. It is to be commissioned during the first quarter of 1964.

However, the old generators of the present plant will soon have to be stopped. The improvement of the distribution will therefore be short-lived and the hydraulic solution must already be contemplated if the requirements have to be met.

4.3 - Determination of requirements

4.31 - Population previsions for the next decade

We already have pointed out that in the absence of a census, the precise population figure is difficult to obtain.

In order to facilitate energy consumption previsions for the uses considered in this study (household, commercial and small industry) one must refer to existing studies made in connexion with the development of Vientiane.

The basis adopted is that of the city development project approved by the Royal Government. This project envisages:

- development of the existing districts;
- creation of new districts;
- concentration in some districts of public services, national and regional services etc...

The anticipated number of inhabitants when the project is implemented is 121 000.

4.32 - Energy requirements - Consumers

4.321 - Private sector

If population be divided in categories such as:

/ - 1st category

- 1st category (well-to-do people) 4 consumers for each subscriber; installed power 2 500 Watts; (about 15% of the number of the inhabitants)
- 2nd category (the most numerous) 5 consumers for each subscriber; installed power 1 000 Watts; (about 75% of the number of the inhabitants)
- 3rd category (rural 1) 6 consumers for each subscriber; installed power 500 Watts; (about 6% of the number of the inhabitants)
- 4th category (rural 2) 6 consumers for each subscriber; installed power 150 Watts (about 4% of the number of the inhabitants)

and if the PEAK RESPONSIBILITY of each of these categories is assessed as follows:

0.12 0.15 0.20 and 0.40

the total peak load is 5 360 kW (the gross results of the computation have been increased by 25% so as to take into account the present uncertainty of the number of inhabitants and the rate of development of the population) and the number of consumers 25 000.

4.322 - Public Sector

In the absence of precisions on the future importance of the different public services, their total peak responsibility has been assumed to be the same as for the private sector, that is about 5 300 kW.

4.323 - Industrial Sector

There is practically no industry whatever at the present time. However, various projects have been prepared, depending upon the situation. We have considered that the industrial sector could account for a load of 4 000 kW or so.

What will its peak responsibility be ?

An examination of the load curve given in Annex will show that, outside the peak which begin at 5.30 p.m. in winter and 6.30 p.m. in summer, the load during the day, is not much in excess of about one third of the peak winter load.

It seems reasonable to assume that the future load curve will be similar (outside the industrial sector) because the peak will remain a lighting peak.

/ The industrial

The industrial sector consumption will therefore easily be contained within the slack of the curve, provided that factories cease working at 5.30 p.m.

Now, this is the time when offices are currently closing and it may be considered that factories will do the same.

It will always be possible to devise a rates system such as will wipe out the peak of the industrial sector (applying lighting rates beginning 5.30 p.m.).

The peak responsability of the industrial sector therefore is nil. However, some industries might have to consume electricity during the peak period and we earmarked 800 kW for the total peak responsability of the industrial sector.

4.324 - Total consumption

The winter PEAK LOAD, as anticipated, is as follows:

private sector	:	5 360 kW
public sector	:	5 300 kW
industrial sector	:	800 kW
		11 460 kW

This estimate does not take into account:

- public lighting
- extension of energy distribution to Vientiane suburbs (within a radius of 8 km or so)
- radio transmitter
- students' home
- USOM compound (100 apartments)
- 2 new hospitals

Assuming that those installations consume about 1 550 kW, the grand peak load total can ben estimated at about: 13 000 kW

/ 4.33 - Plant Power

4.33 - Plant Power

The consumption peak being estimated at 13 000 kW, the output of the distribution network has to be taken into account. If renovated, it could have an output of 0.85 This being so, the necessary power at the production plant should be:

$$\frac{13\,000}{0.85} = 15\,300 \text{ kW}$$

Assuming a loss of about 5% in the transmission system from the Nam Ngum site, the power at the plant should be:

$$\frac{15\,300}{0.95} = 16\,100 \text{ kW}$$

It seems reasonable to envisage that the station at the Nam Ngum plant will also supply the locality of Ban-Keun, at about 16 km from the contemplated dam site. This center, already important, is sure to develop owing to the re-location of population that is going on in that area. Its small salt industry, currently fonctioning with primitive installations could also consume certain amount of electricity, to say nothing of the local crafts that might develop.

The possible consumption of that center can very conservatively be assessed at 500 kW.

On the whole, it may reasonably anticipated that the power requirements for Vientiane alone might reach:

16 100 kW + 500 kW = 16 600 kW

This figure is very close to the unit capacity of one of the generators of the contemplated plants - 20 000 kW - not including the plant's own requirements.

/ 4.34 - Energy

4.34 - Energy consumption and production

Consumption is a determining factor in the operation budget. Its value must therefore be estimated.

Taking as a basis - minimum evaluation - for the public and private sectors the same low level of utilization as now, that is 2 580 hours, the result is:

Public sector: 10 660 x 2 580 = 27 500 000 kWh

For the industrial sector, we shall take as a basis a 2 000 hours utilization, which gives:

4 000 x 2 000 = 8 000 000 kWh

that is a total of 27 500 000 + 8 000 000 = 35 500 000 kWh

Under the same conditions, ENERGY PRODUCTION, at the hydraulic power plant, should be:

$$35\ 500\ 000 \times \frac{1}{0,85} \times \frac{1}{0.95} = 44\ 000\ 000 \text{ kWh}$$

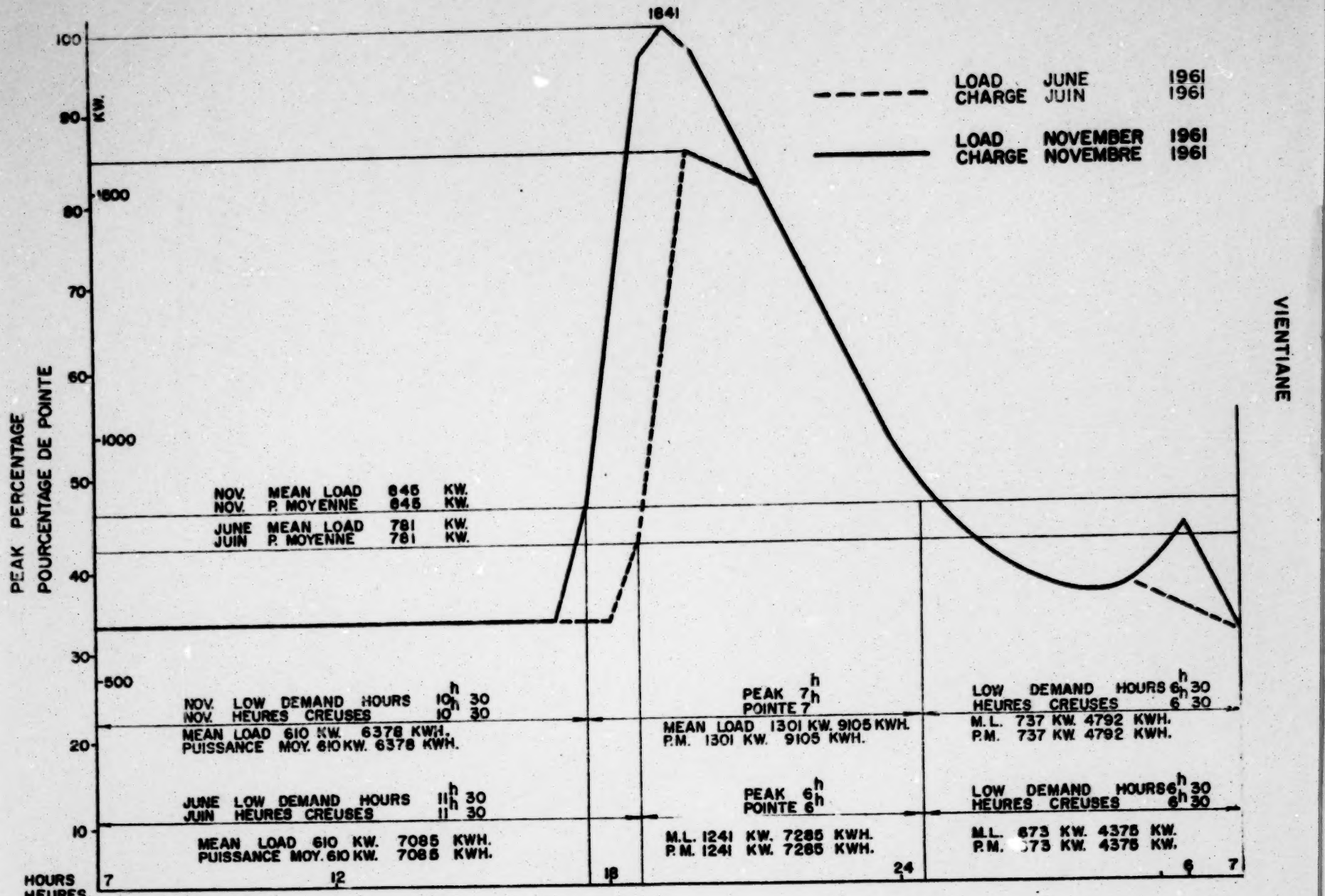
It is reasonable to assume that after 1970, when sufficient energy becomes available at more attractive rates, the conservative estimates given in this report will rapidly be outgrown. A twofold consumption increase in 3 to 4 years may be anticipated in the light of previous experience in other countries of the region.

4.35 - Energy of thermal origin

The Nippon Koei C. Ltd. in their 1962 report on the Nam Ngum River development project (table 7.4.1; page 112) made a comparative study on the cost of energy of thermal origin and the cost of energy of hydraulic origin. The figures given sufficiently illustrate the advantages of hydraulic production to make it unnecessary to describe them over again.

/ However,

However, the interest of a solution freeing laotien economy from the necessity of importing petroleum products, the volume of which will grow as the power consumption expands, must be stressed again.


1841
100
90
80
70
60
50
40
30
20
10
KW.
1800
1000
500
PEAK PERCENTAGE
POURCENTAGE DE POINTE
LOAD JUNE 1961
CHARGE JUIN 1961
LOAD NOVEMBER 1961
CHARGE NOVEMBRE 1961
NOV. MEAN LOAD 845 KW.
NOV. P. MOYENNE 845 KW.
JUNE MEAN LOAD 781 KW.
JUIN P. MOYENNE 781 KW.
NOV. LOW DEMAND HOURS 10h 30
NOV. HEURES CREUSES 10h 30
MEAN LOAD 610 KW. 6378 KWH.
PUISSANCE MOY. 610 KW. 6378 KWH.
JUNE LOW DEMAND HOURS 11h 30
JUIN HEURES CREUSES 11h 30
MEAN LOAD 610 KW. 7085 KWH.
PUISSANCE MOY. 610 KW. 7085 KWH.
PEAK 7h
POINTE 7h
MEAN LOAD 1301 KW. 9105 KWH.
P.M. 1301 KW. 9105 KWH.
PEAK 6h
POINTE 6h
M.L. 1241 KW. 7285 KWH.
P.M. 1241 KW. 7285 KWH.
LOW DEMAND HOURS 6h 30
HEURES CREUSES 6h 30
M.L. 737 KW. 4792 KWH.
P.M. 737 KW. 4792 KWH.
LOW DEMAND HOURS 6h 30
HEURES CREUSES 6h 30
M.L. 673 KW. 4375 KW.
P.M. 673 KW. 4375 KW.
HOURS
HEURES
7
12
18
24
6
7
VIENTIANE